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(54) **ELLIPTICAL TRAINER WITH CHANGEABLE FOOT MOTION**

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A63B 22/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A63B 22/0664*** (2013.01); ***A63B 22/001*** (2013.01)

(58) **Field of Classification Search**
CPC A63B 21/00058; A63B 21/00069; A63B 21/00076; A63B 21/00192; A63B 21/0056; A63B 21/008; A63B 21/0083; A63B 21/0085; A63B 21/0087; A63B 21/22; A63B 21/225; A63B 21/4033; A63B 21/4034; A63B 21/4045; A63B 21/4047; A63B 21/4049; A63B 22/001; A63B 22/0015; A63B 22/0017; A63B 22/0046; A63B 22/0048; A63B 22/06; A63B 22/0664; A63B 22/0694; A63B 2022/0051; A63B 2022/0053; A63B 2022/0676; A63B 2022/0682; A63B 23/035; A63B 23/03516; A63B 23/03533; A63B 23/03575; A63B 23/04; A63B 23/0405; A63B 23/0423; A63B 23/0429; A63B 23/0482; A63B 23/0494; A63B 23/12; A63B 23/1209; A63B 23/1245; A63B 23/1263; A63B 23/1281; A63B 2023/0441; A63B 2023/0447; A63B 2023/0452; A63B 69/182; A63B 71/0054; A63B 2071/0072; A63B 2208/02; A63B 2208/0204; A63B 2225/09; A63B 2225/093; A63B 2225/096
See application file for complete search history.

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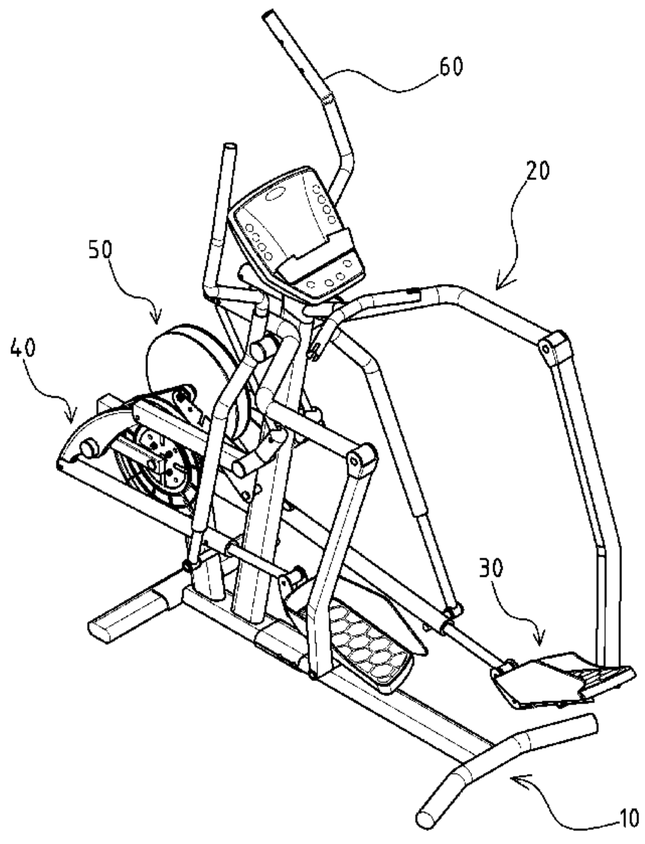
(57) **ABSTRACT**

An elliptical trainer has a main frame having two opposite sides, each having a linking device, a stepping device and an interlocking device mounted thereon, wherein the interlocking device is provided to connect the linking device and the stepping device. A damping device is mounted on the main frame and operated with the two interlocking devices so as to promote exercise on the elliptical trainer. A longitudinal axis of an elliptical foot motion of each stepping device is adjusted due to a step force from an operator for changing a working stroke of the elliptical trainer.

12 Claims, 9 Drawing Sheets



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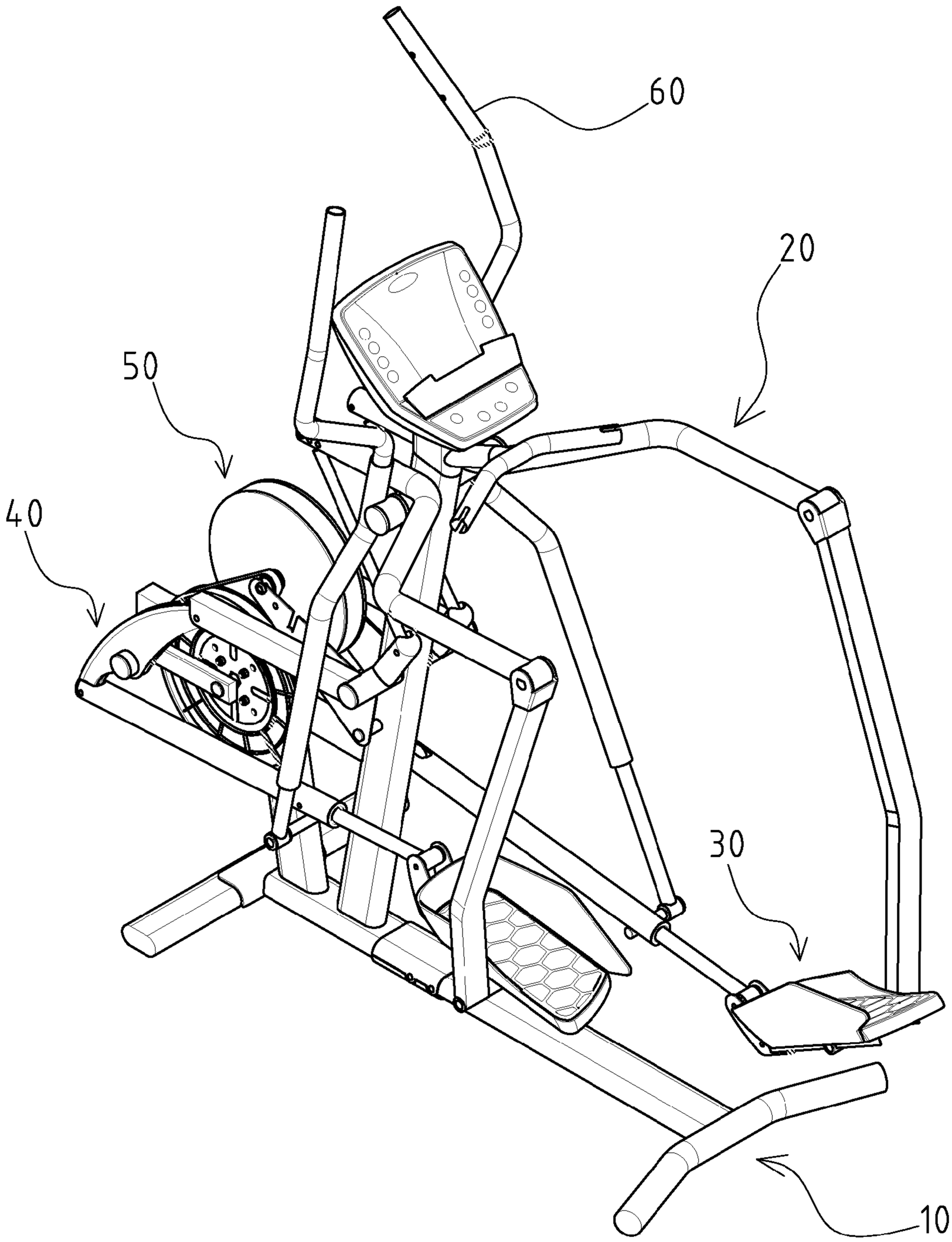

FIG.1

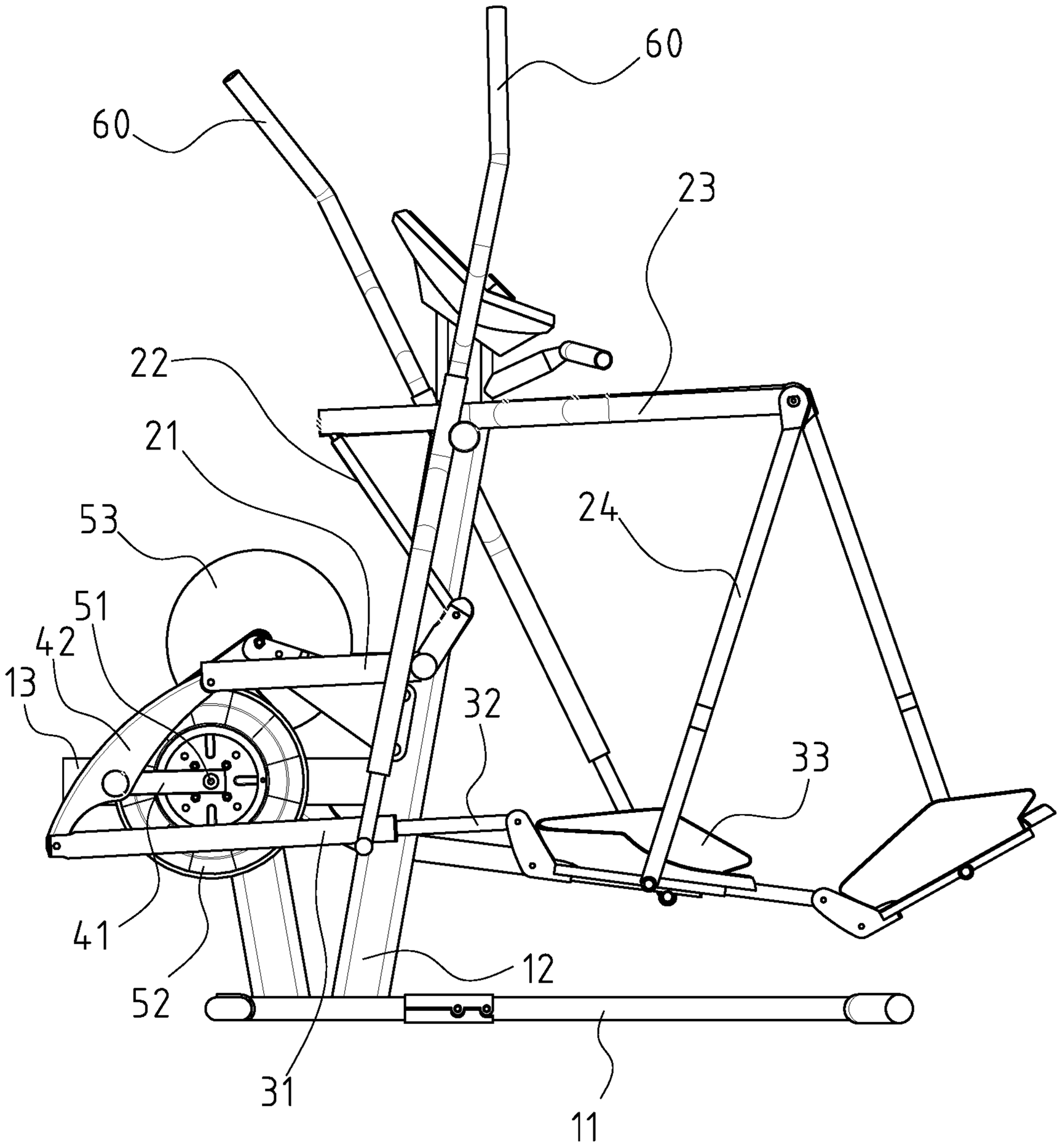

FIG.2

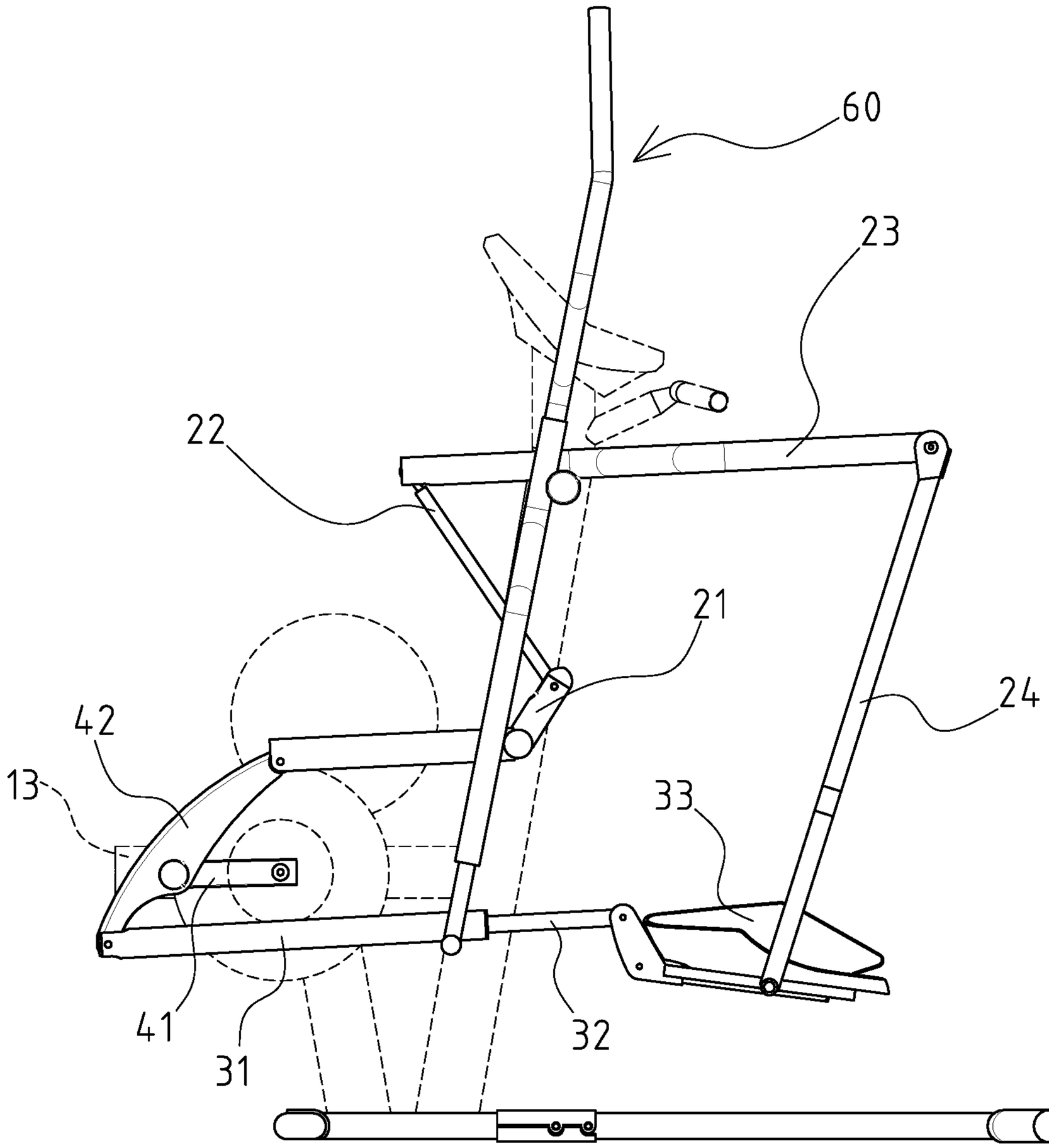

FIG.3

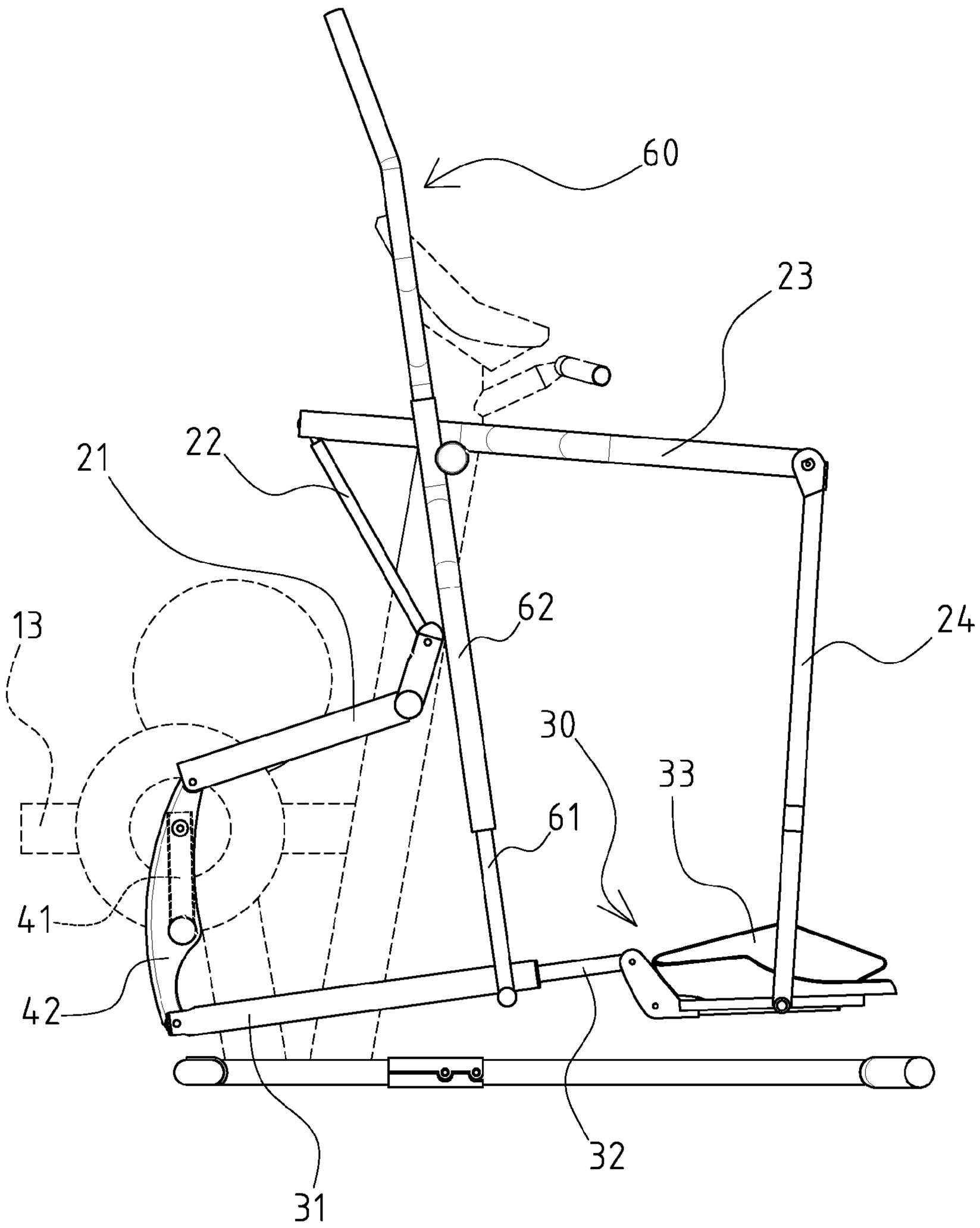

FIG.4

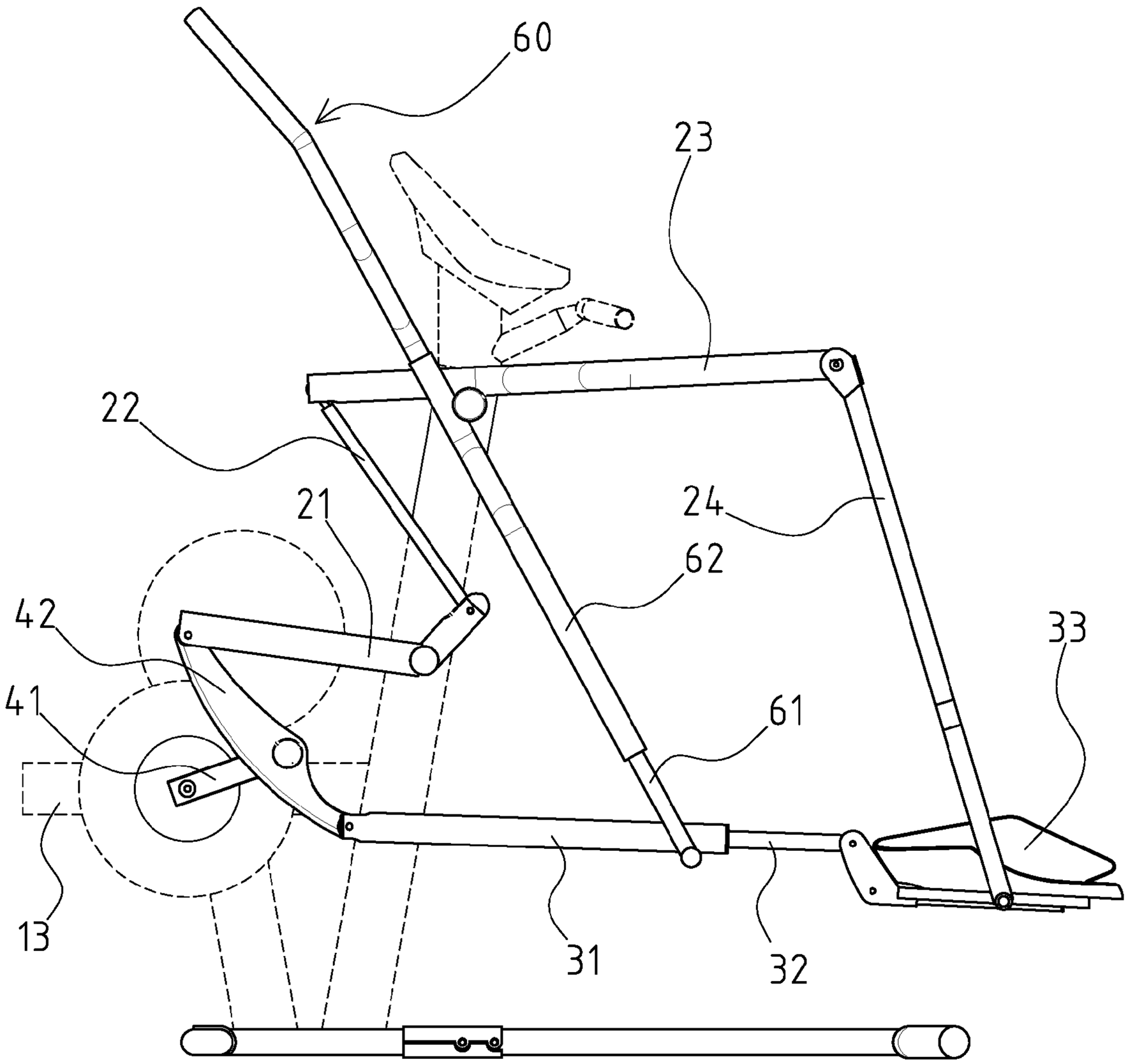

FIG.5

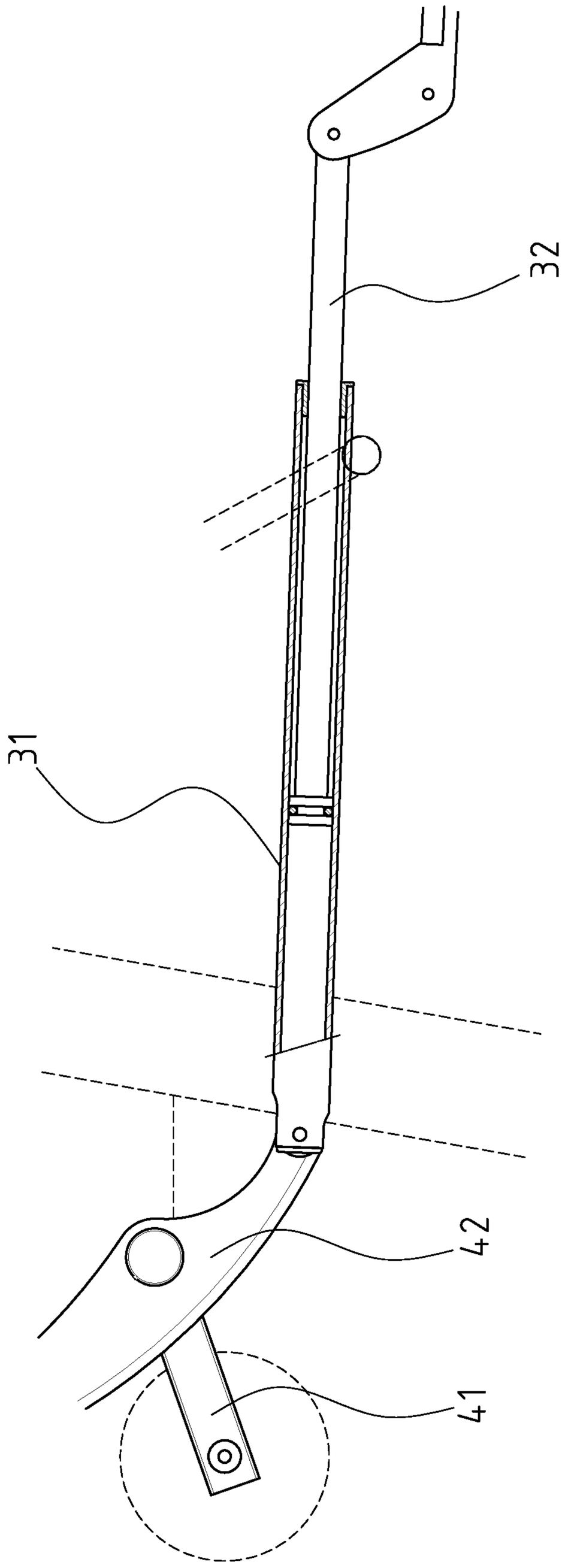

FIG.6

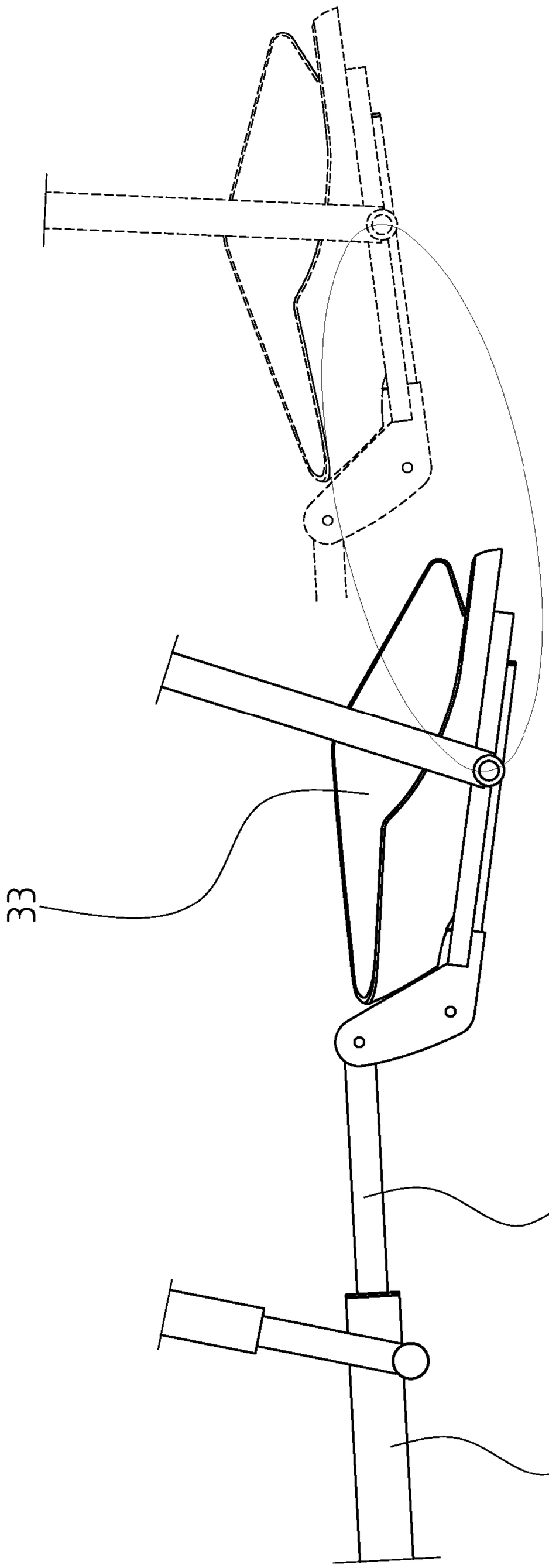

FIG.7

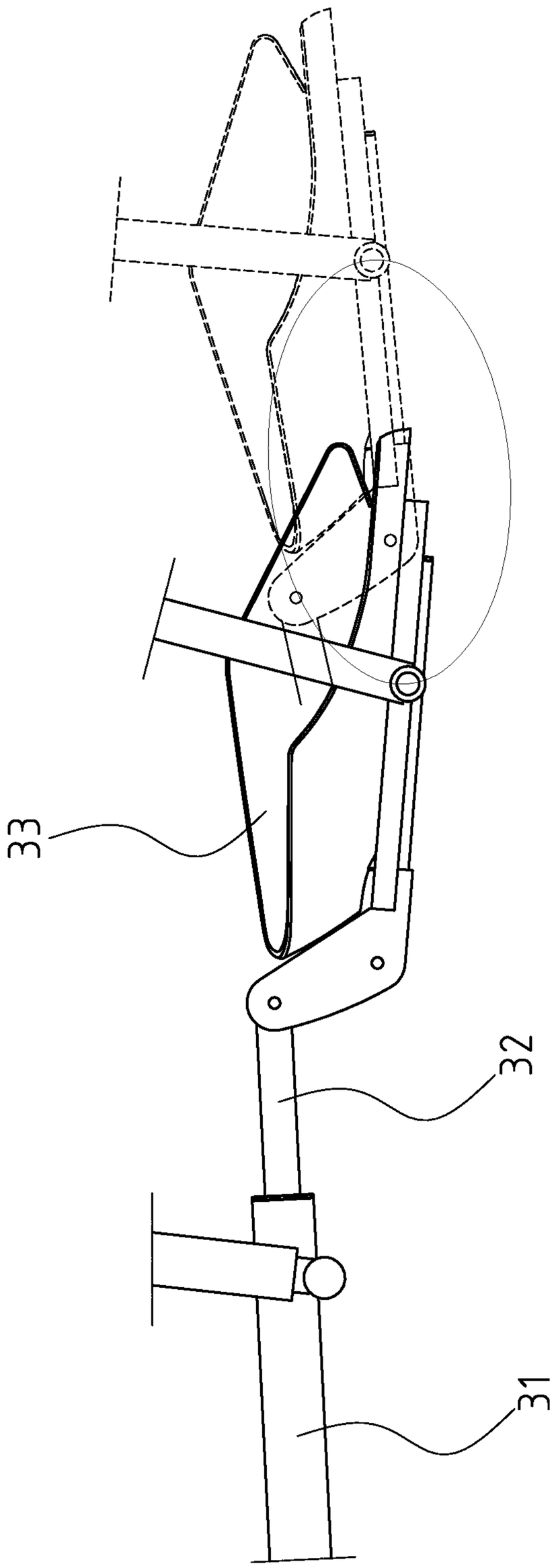

FIG.8

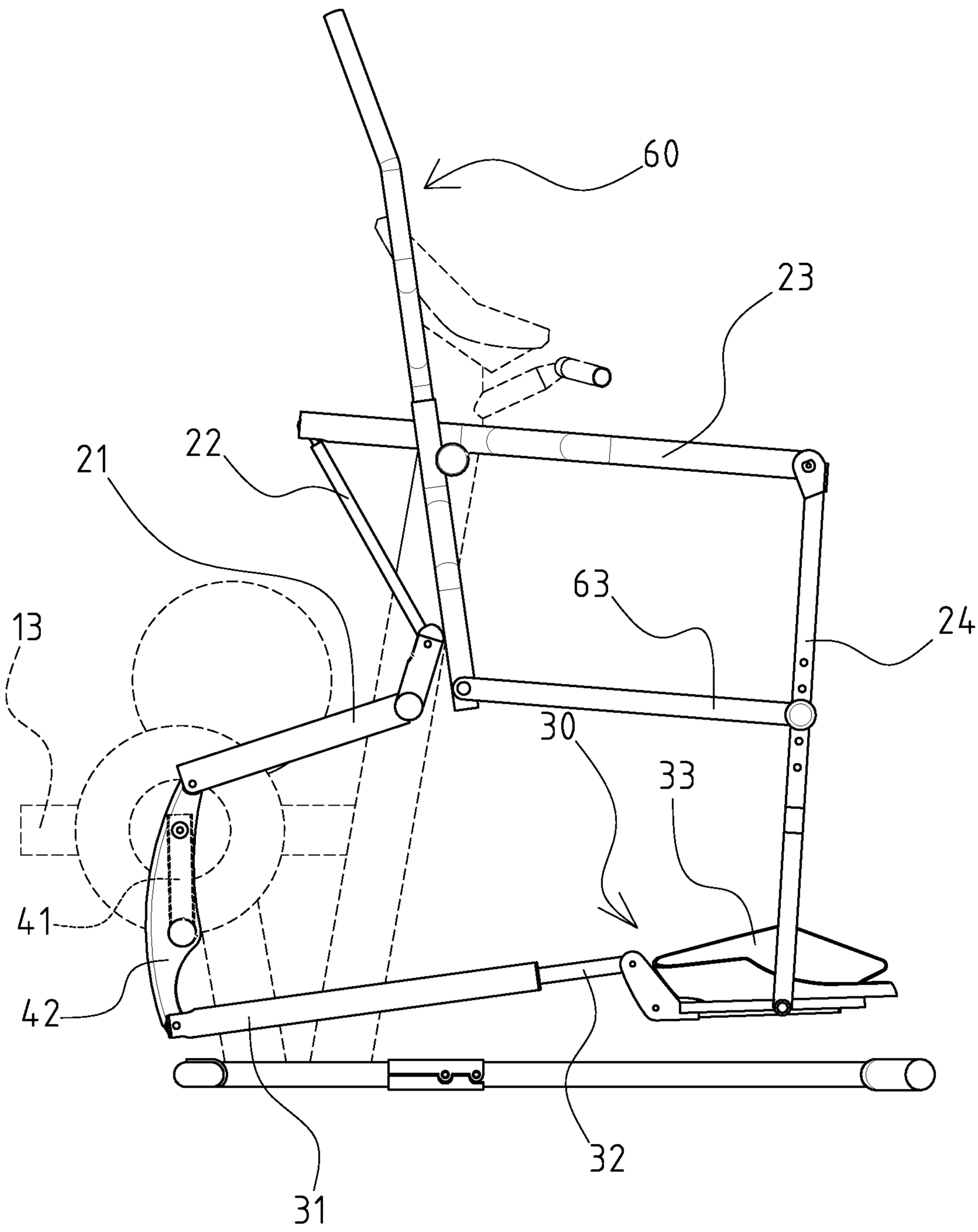

FIG.9

ELLIPTICAL TRAINER WITH CHANGEABLE FOOT MOTION

CROSS-REFERENCE TO RELATED U.S. APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not applicable.

NAMES OF PARTIES TO A JOINT RESEARCH AGREEMENT

Not applicable.

REFERENCE TO AN APPENDIX SUBMITTED ON COMPACT DISC

Not applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an elliptical trainer, and more particularly to an elliptical trainer with changeable foot motion.

2. Description of Related Art Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98

In various exercisers, an elliptical trainer is popular because the elliptical trainer can imitate motions of feet and legs during walking. However, the original elliptical trainer has no adjusting functions such that the motion cannot be adjusted relative to the height and size of users. Furthermore, the original elliptical trainer without adjusting function may cause a sport injury. Consequently, the original elliptical trainer needs to be altered.

A conventional elliptical trainer includes a base and a stem extending from the base. A left linkage structure and a right linkage structure respectively mounted onto two opposite sides of the stem. Each linkage structure includes a step set moved back and forth. An interlocking device is disposed on the stem and connected to the two step sets for providing an elliptical motion to the two step sets. A left adjusting device and a right adjusting device are respectively pivotally mounted onto the stem for adjusting the elliptical motion of each of the two step set.

The conventional elliptical trainer has two adjusting ways for adjusting the elliptical motion of each of the two step set and the two adjusting ways are respectively described as follow.

Hand regulation uses a shaft with multiple through holes and an adjusting set sleeved on the shaft for providing adjusting function, wherein the adjusting set includes a tubular element movably sleeved on the shaft and a locking pin reciprocally movably mounted on the tubular element. The locking pin is selectively inserted into a corresponding one of the through holes for providing the adjusting function. However, this adjusting method cannot provide a stepless adjustment. In addition, the shaft must define more through holes for providing a finer adjustment. However, the more and more through holes will reduce the strength of the shaft.

Electric regulation uses a threaded shaft and a linear slider to provide a stepless adjustment. As well known, a servo motor or a DC motor is necessary for driving the threaded shaft and make the threaded shaft being rotated relative to the slider. However, the servo motor and the DC motor are very expensive elements for the conventional elliptical trainer. An expensive price will reduce the market competitiveness of the conventional elliptical trainers such that the conventional elliptical trainers in accordance with the prior need to be advantageously altered.

The present invention has arisen to mitigate and/or obviate the disadvantages of the conventional elliptical trainers.

BRIEF SUMMARY OF THE INVENTION

The main objective of the present invention is to provide an improved elliptical trainer adjust a length of a long axis of the elliptical foot motion due to the step force from an operator.

To achieve the objective, the elliptical trainer in accordance with the present invention comprises a main frame having two opposite sides each having a linking device, a stepping device and an interlocking device mounted thereon, wherein the interlocking device is provided to connect the linking device and the stepping device. A damping device is mounted on the main frame and operated with the two interlocking devices for promoting the exercise effect of the elliptical trainer. Each interlocking device includes a crank having a first end secured on a corresponding one of the two ends of the axle and a linkage having a middle portion pivotally mounted onto a second end of the crank, wherein the two cranks oppositely extend and linearly correspond to each other. Each linkage has two opposite ends respectively pivotally connected to a corresponding one of the two linking devices and the two stepping devices. The linking device includes a swing linkage laterally pivotally mounted onto the stem. The swing linkage has a first end pivotally connected to a first end of the linkage and a second end pivotally connected to a first end of a first linkage. A second linkage is laterally and pivotally mounted onto the stem, and has a front end and a rear end, wherein the front end of the second linkage is pivotally connected to a second end of the first linkage. A third linkage has an upper end pivotally connected to the rear end of the second linkage and a lower end pivotally connected to the stepping device. The stepping device has a front end and a rear end respectively pivotally connected to a second end of the linkage and the lower end of the third linkage. The stepping device is divided into a front section and a rear section linearly strung together, wherein the front end of the front section is pivotally connected to the second end of the linkage. A pedal is pivotally connected to a rear end of the rear section and the lower end of the third linkage laterally pivotally connected to the pedal. The rear section is reciprocally and longitudinally moved relative to the front section for changing the total length of the stepping device to adjust a length of a long axis of the elliptical foot motion of the elliptical trainer due to the step force from an operator.

Further benefits and advantages of the present invention will become apparent after a careful reading of the detailed description with appropriate reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a perspective view of an elliptical trainer in accordance with the present invention.

FIG. **2** is a side plan view of the elliptical trainer in FIG. **1**.

FIG. **3** is a side plan view of the elliptical trainer in FIG. **1** when the pedal is moved to a front end of an original foot motion.

FIG. **4** is a side plan view of the elliptical trainer in FIG. **1** when the pedal is moved to a middle portion of an original foot motion.

FIG. **5** is a side plan view of the elliptical trainer in FIG. **1** when the pedal is moved to a rear end of an original foot motion.

FIG. **6** is a partially cross-sectional view of the stepping device of the elliptical trainer in accordance with the present invention.

FIG. **7** is a side plan view for showing the original foot motion.

FIG. **8** is a side plan view for showing an adjusted foot motion, wherein the long axis of the original foot motion, as shown in FIG. **7**, is shortened.

FIG. **9** is side plan view of a second embodiment of the elliptical trainer in accordance with the preset invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings and initially to FIGS. **1-3**, an elliptical trainer in accordance with the present invention comprises a main frame **10** having two opposite sides each having a linking device **20**, a stepping device **30** and an interlocking device **40** mounted thereon wherein the interlocking device **40** is provided to connect the linking device **20** and the stepping device **30**. A damping device **50** is mounted on the main frame **10** and operated with the two interlocking devices **40** for promoting the exercise effect of the elliptical trainer. A long axis of the elliptical foot motion of the two stepping device **30** is adjusted due to the step force from the operator for changing the working stroke.

The main frame **10** includes an I-shaped base **11**, a stem **12** extending from a front portion of the base **11**, and a support **13** connected to the base **11** and the stem **12**.

The damping device **50** includes a flywheel **52** rotatably mounted on the support **13** by an axle **51** and a damping wheel **53** rotatably mounted on the support **13**, wherein the damping **53** is operated with the flywheel **52** for promoting the exercise effect of the elliptical trainer.

Each interlocking device **40** in includes a crank **41** having a first end secured on a corresponding one of the two ends of the axle **51** and a linkage **42** having a middle portion pivotally mounted onto a second end of the crank **41**, wherein the two cranks **41** oppositely extend and linearly correspond to each other. Each linkage **42** has two opposite ends respectively pivotally connected to a corresponding one of the two linking devices **20** and the two stepping devices **30**.

The linking device **20** includes a swing linkage **21** laterally pivotally mounted onto the stem **12**, wherein the swing linkage **21** is boomerang-shaped and formed with a corner pivotally mounted onto the stem **12**. The swing linkage **21** has a first end pivotally connected to a first end of the linkage **42** and a second end pivotally connected to a first end of a first linkage **22**. A second linkage **23** is laterally and pivotally mounted onto the stem **12**. The second linkage **23** has a front end and a rear end, wherein the front end of the second linkage **23** is pivotally connected to a second end of the first linkage **22** and a third linkage **24** having an upper

end pivotally connected to the rear end of the second linkage **23**. The third linkage **24** has a lower end pivotally connected to the stepping device **30**.

The stepping device **30** has a front end and a rear end respectively pivotally connected to a second end of the linkage **42** and the lower end of the third linkage **24**. The stepping device **30** is divided into a front section **31** and a rear section **32** linearly strung together, wherein the front end of the front section **31** is pivotally connected to the second end of the linkage **42**, a pedal **33** is pivotally connected to a rear end of the rear section **32** and the lower end of the third linkage **24** is laterally pivotally connected to the pedal **33**. The rear section **32** is reciprocally and longitudinally moved relative to the front section **31** for changing the total length of the stepping device **30** to adjust the elliptical foot motion of the elliptical trainer and a restitution force is provided between the front section **31** and the rear section **32**. With reference to FIG. **6**, the front section **31** and the rear section **32** are assembled as a cylinder. In addition, the front section **31** and the rear section **32** are also assembled as a rail and a slider.

The elliptical trainer in accordance with the present invention further includes two handlebars **60** respectively pivotally connected to two opposite sides of the main frame **10**. Each handlebar **60** has a lower end pivotally connected to a front end **31** of a corresponding one of the two stepping devices **30** and an upper end for being handled during being operated. The handlebar **60** has an inner tube **61** and an outer tube **62**, wherein the inner tube **61** is partially and movably received in the outer tube **62**, such that the total length of the handlebar **60** is changed due to the long axis of the elliptical foot motion of the pedal **33**.

With reference to FIGS. **4**, **5** and **6**, driving feature of the elliptical trainer in accordance with the present invention is a six bar linkage mechanism including the stepping device **30**, the linkage **42**, the swing linkage **21**, the first linkage **22**, the second linkage **23** and the third linkage **24** pivotally connected to one another for imitating an elliptical walking motion. In addition, the six bar linkage mechanism of the present invention can lengthen a long axis of the elliptical walking motion for enhancing the leg-raising action and training the muscle strength of user's legs.

The difference between the present elliptical trainer and the conventional elliptical trainer is the adjusting mode. The elliptical trainer in accordance with the present invention provides two adjusting modes, including aggressive adjusting mode and passive adjusting mode, to the elliptical trainer user. In the passive adjusting mode: the linkage **42** is disposed between the stepping device **30** and the crank **41** and the operated linkage **42** can lengthen the long axis of the elliptical foot motion of the conventional elliptical trainer. In the aggressive adjusting mode: with reference to FIG. **7**, the rear section **32** is reciprocally and longitudinally moved relative to the front section **31** for changing the total length of the stepping device **30** to adjust the elliptical foot motion of the elliptical trainer and a restitution force is provided between the front section **31** and the rear section **32**. Consequently, the rear section **32** is backward moved relative to the front section **31** and the total length of the stepping device **30** is lengthen when the user forced step the pedal **33**. Accordingly, the long axis of the foot motion of the elliptical trainer in accordance with the preset invention is lengthened. By using the above six bar linkage mechanism, the rear end of the foot motion of the elliptical trainer is raised for enhancing the exercise effect of the user's calfs when the long axis of the foot motion of the elliptical trainer is lengthened. With reference to FIG. **8**, the rear section **32**

is gradually forward moved relative to the front section **31** when the step force from the operator is gradually weakened after operating the elliptical trainer for a period of time. Accordingly, the long axis of the foot motion of the elliptical trainer in accordance with the preset invention is gradually shortened to gradually reducing the exercise load of the user before stopping the elliptical trainer.

With reference to FIG. **9** that shows a second embodiment of the present invention, in this preset invention, the lower end of each of the two handlebars **60** is pivotally connected to a first end of a linkage **63** and the linkage **63** of has a second end pivotally connected to a corresponding one of the two third linkage **24** for enhancing the swing range of an upper end of the handlebar **60**.

Although the invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

I claim:

1. An elliptical trainer comprising:

a main frame having two opposite sides;

a linking device mounted on each of said two opposite sides of said main frame;

a stepping device mounted on each of said two opposite sides of said main frame;

an interlocking device mounted on each of said two opposite sides of said main frame, wherein said interlocking device connects said linking device and said stepping device; and

a damping device mounted on said main frame and cooperative with the two interlocking devices so promote exercise on the elliptical trainer, each interlocking device has a crank having a first end secured on a corresponding one of two ends of an axle and a linkage having a middle portion pivotally mounted onto a second end of said crank, wherein the two cranks oppositely extend and linearly correspond to each other, each of the linkages having two opposite ends respectively pivotally connected to a corresponding one of the two linking devices and a corresponding one of the two stepping devices, said linking device having a swing linkage laterally and pivotally mounted onto a stem, said swing linkage having a first end pivotally connected to a first end of the linkage and a second end pivotally connected to a first end of a first linkage, a second linkage laterally and pivotally mounted onto the stem, said second linkage having a front end and a rear end, wherein a front end of the second linkage is pivotally connected to a second end of the first linkage, wherein a third linkage has an upper end pivotally connected to the rear end of the second linkage, the third linkage having a lower end pivotally connected to the corresponding stepping device, the stepping device has a front end and a rear end respectively pivotally connected to a second end of the linkage and the lower end of the third linkage, the stepping device divided into a front section and a rear section linearly strung together, wherein the front end of the front section is pivotally connected to the second end of the linkage, a pedal being pivotally connected to the rear end of the rear section, the lower end of the third linkage laterally and pivotally connected to the pedal, and the rear section reciprocally and longitudinally moves relative to the front section for changing a total length of the corresponding stepping device to adjust a length of a longitudinal axis of elliptical foot motion of the elliptical trainer due to a step force from an operator.

2. The elliptical trainer of claim **1**, wherein said main frame includes an I-shaped base, the stem extending from a front portion of the base, and a support connected to the base and the stem, said damping device having a flywheel rotatably mounted on the support by the axle and a damping wheel rotatably mounted on the support, wherein the damping wheel is cooperative with the flywheel so as to promote exercise on the elliptical trainer.

3. The elliptical trainer of claim **2**, further comprising:

a pair of handlebars respectively pivotally connected to the two opposite sides of the main frame, wherein each of said pair of handlebars has a lower end pivotally connected to the front end of a corresponding one of the stepping devices and an upper end that is adapted to be handled by the operator.

4. The elliptical trainer of claim **3**, wherein each of said pair of handlebars has an inner tube and an outer tube, the inner tube partially and movably received in the outer tube such that a total length of each of said pair of handlebars is changed due to the longitudinal axis of elliptical foot motion of the elliptical trainer.

5. The elliptical trainer of claim **4**, wherein the front section and the rear section of said stepping device are assembled as a cylinder.

6. The elliptical trainer of claim **2**, further comprising:

a pair of handlebars respectively pivotally connected to the two opposite sides of said main frame, wherein a lower end of each of the pair of handlebars is pivotally connected to a first end of another linkage and the another linkage has a second end pivotally connected to a corresponding one of the third linkages so as to enhance a swing range of an upper end of the corresponding handlebar.

7. The elliptical trainer of claim **6**, wherein the front section and the rear section of said stepping device are assembled as a cylinder.

8. The elliptical trainer of claim **1**, further comprising:

a pair of handlebars respectively pivotally connected to the two opposite sides of said main frame, wherein each of said pair of handlebars has a lower end pivotally connected to the front end of a corresponding one of the stepping devices and an upper end that is adapted to be handled by the operator.

9. The elliptical trainer of claim **8**, wherein each of said pair of handlebars has an inner tube and an outer tube, the inner tube being partially and movably received in the outer tube such that a total length of each of said pair of handlebars is changed due to the longitudinal axis of the elliptical foot motion of the elliptical trainer.

10. The elliptical trainer of claim **9**, wherein the front section and the rear section of said stepping device are assembled as a cylinder.

11. The elliptical trainer of claim **1**, further comprising:

a pair of handlebars respectively pivotally connected to the two opposite sides of said main frame, wherein a lower end of each of said pair of handlebars is pivotally connected to a first end of another linkage and the another linkage has a second end pivotally connected to a corresponding one of the third linkages so as to enhance a swing range of an upper end of the corresponding handlebar.

12. The elliptical trainer of claim **11**, wherein the front section and the rear section of said stepping device are assembled as a cylinder.

* * * * *